up, in shape of the inchoate *eidolon-fori* of some nameless dreamy inventor.

Technical journalism, in the field of electrical power at least, would seem to be at a low ebb in New York.

As for the current-generating plant and conductive system, they, as well as the "Franklin," are entirely of the Daft design. The former is on Fifteenth Street, about midway between Sixth and Seventh Avenues, and wires of suitable size convey the current to and fro between the stationary plant and the track-conductors. A steam-engine of 250 horse-power drives four dynamo-generators of 50 horse-power each.

The conductor is a copper rod, five-eighths of an inch in diameter, sustained by insulators attached to the guard-timbers alongside the track. Elastic copper "brushes" pressing against and sliding along this rod convey the current to the electro-motive mechanism, which it traverses, causing revolution by its passage, and completes its circuit through the wheels and track-rails.

Time and space will not admit of an analysis of the inherent and incidental economy of electric propulsion; but "he who runs may read," whether or no the preference lies with the light, comparatively noiseless, cleanly electro-locomotor, devoid of steam, smoke, cinder, and hot *jets d'eau*, or the ponderous, clamorous, steam-locomotive, wasteful of fuel, destructive of road-bed, and inherently hampered by nuisances from which its electric rival is absolutely free. X.

THE WORTHINGTON INDEPENDENT CONDENSER.

THAT the practical results attained by condensing-engines should approximate to those that theory indicates, it is important that the condensing-apparatus employed should be the most efficient possible; that it should maintain the highest vacuum, with the least cost of production; that it should be regular and reliable in action, and simple in construction; and that its application to the engine should be unaccompanied by any risk of accident. These exacting requirements, it is claimed, are fully met by the condenser shown in the accompanying illustrations.

Exhaust-steam from an engine enters a vacuum with a velocity of about 1,900 feet per second; and water, under atmospheric pressure, with a velocity of 47 feet a second. Excepting the machine herein described, it may be said that in all forms of jet-condensers operated by air-pumps, the injection-water and the water from the steam fall to the bottom of the condensing-chamber, come to a standstill before entering the pump, and consequently lose the valuable momentum acquired when entering the vacuous space. In this condenser, however, the construction and arrangement are such that the momentum of the steam and water is conserved, and this force is utilized to assist the pump in its work.

By a careful adaptation of the injector principle, it is possible, in an experimental way, to produce a vacuum, of low degree however, without the use of a pump at all, — simply by the momentum given to a flow of water by the impact of the exhaust-steam at the point of condensation. A condenser dependent upon this alone is not practical, because of its small range of action, the inferior vacuum it obtains, and the low temperature of the discharge-water. A change of the amount of steam to be condensed disturbs the theoretical conditions, and renders this kind of apparatus too unreliable in practice. It is plain that the addition of a duplex pump to the discharge of such an ejector condenser perfects and governs its action. As the momentum of the water is not impaired, the highest economy of operation is reached.

In this condenser, the air set free by the condensation of the steam is intermingled with the water. The pump has the same regularity of motion that is characteristic of Worthington pumping machinery; in fact, it acts as a water-pump, although the water is aerated. There is here a great distinction between this condenser pumping aerated water, and an air-pump pumping air and water unmixed. In the latter case, the air-pump has a varying and irregular duty to perform, and the inevitable result is an irregular and slamming movement.

The lower of the accompanying illustrations is a longitudinal section of one side of the condenser-pump, and also a section of the condenser-cone, spray-pipe, exhaust-elbow, and injection-elbow. *A* is the vapor-opening, to which is connected the pipe that conducts to the apparatus the steam or vapor that is to be condensed, and in which a vacuum is to be made and maintained. The injection-water used to produce the condensation of the steam or vapor is conveyed by a proper pipe attached to the injection-opening at *B*. *C* is the spray-pipe, and has at its lower extremity a number of vertical slits, through which the water of injection passes, and becomes spread out into thin sheets. The spray-cone *D*, by means of its serrated surface, breaks the water passing over it into fine spray, and thus insures a rapid and thorough intermixture with the steam. This spray-cone is adjustable by means of the handle *E*. The piston-pump *G* is of the well-known Worthington type; built, however, with especial attention to the requirements of the service which is now being considered. *H H* shows the position of the induction, and *I I* of the eduction valves. *J* is the discharge-opening. At *K* may be seen the steam or engine end of the machine, the standard form used on all Worthington steam-pumps. The steam-valve is an ordinary slide-valve, working upon a flat surface over ports or openings. The motion of this valve is produced by a vibrating arm, *L*, which swings through the whole length of the stroke with long and easy leverage.

This valve motion is a prominent feature of the Worthington independent condenser. To it is due the complete exemption from noise or concussive action. The two pumps are placed side by side, and so combined as to act reciprocally upon the steam-valves of each other. One piston acts to give steam to the other, after which it finishes its own stroke and waits for its valve to be acted upon before it can renew its motion. This pause allows all the water-valves to seat quietly, and removes every thing like harshness of motion.

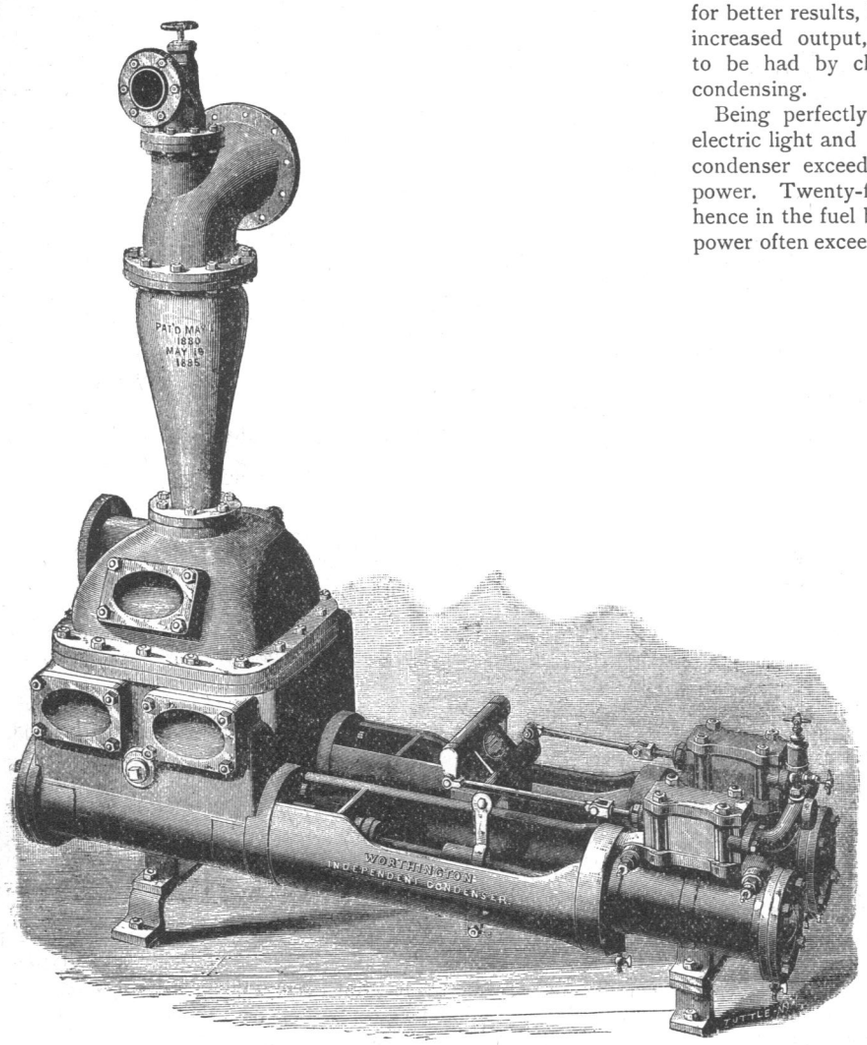
As one or the other of the steam-valves must always be open, there can be no dead point. The pump is therefore always ready to start when steam is admitted, and is managed by the simple opening and shutting of the throttle-valve.

The operation of the condensing-apparatus is as follows: Steam being admitted to the cylinders *K*, so as to set the pump in motion, a vacuum is formed in the condenser, the engine-cylinder, the connecting exhaust-pipe, and the injection-pipe. This causes the injection-water to enter through the injection-pipe attached at *B*, and spray-pipe *C*, into the condenser-cone *F*. The main engine being then started, the exhaust-steam enters through the exhaust-pipe at *A*, and, coming into contact with the cold water, is rapidly condensed. The velocity of the steam is communicated to the water, and the whole passes through the cone *F* into the pump *G* at a high velocity, carrying with it, in a thoroughly commingled condition, all the air or uncondensable vapor which enters the condenser with the steam. The mingled air and water are discharged by the pump through the valves and pipe at *J*, before sufficient time or space has been allowed for separation to occur.

It will be seen that the zone in which the condensation takes place is small, and the rapid effect is due only to the immense surface exposed by the spraying water. In case the water accumulates in the condenser-cone *F*, either by reason of an increased supply or by a sluggishness or even stoppage of the pump, as soon as the level of the water reaches the spray-pipe and the spray becomes submerged, the vast surface is reduced to a minimum, only a small annular ring being exposed to the steam from the main engine. The vacuum is immediately broken, and the exhaust-steam escapes by blowing through the injection-pipe and through the valves of the pump, and out the discharge-pipe at *J*, forcing the water ahead of it: consequently flooding does not occur.

These condensers have been constructed from those of a very small size up to those of enormous power. Two, which are probably the largest independent condensers in the world, are now applied to an engine of 8,000 horse-power, the injection-water of which amounts to 15,000 gallons a minute, or what is equivalent to about 20,000,000 gallons a day. Many of them are in use in connection with stationary steam-engines, and with marine engines on boats running in fresh water. The Worthington condenser is also used in connection with surface condensers on sea-going steamers, where it has a field of usefulness that is at once apparent to those who will but consider its functions. It performs the duty of two distinct pumps, — the air-pump and the circulating pump. It

produces a high vacuum, and causes a forced or positive movement of the cooling-water. By its use, derangement of the surface-condenser does not deprive the engine of the vacuum, as the independent condenser can be used as a jet-condenser for the time being. The fact that one pump is dispensed with, should, in itself, commend the arrangement to the attention of engineers.



THE WORTHINGTON INDEPENDENT CONDENSER.

It is also a valuable adjunct to electric-lighting plants. Many of the plants that were erected during the early period of the history of electric lighting, were located indiscriminately. The boilers and engines were not the most economical, but answered well for a time. Those companies that were fortunate enough to find themselves adjacent to water-supply, when they began to look around for better results, have not waited long to avail themselves of the increased output, or the corresponding saving in fuel, that is to be had by changing the engines from non-condensing to condensing.

Being perfectly adapted to high-speed dynamo-engines, many electric light and power companies have found this independent condenser exceedingly valuable in connection with their steam-power. Twenty-five per cent saving in steam-consumption, and hence in the fuel burned, is frequently obtained. The increase in power often exceeds thirty per cent. In one of the above cases the gain is used to save steam, and in another to increase the output of power with same consumption of steam, and hence same fuel burned. There is a medium between these methods, and fuel can be saved and also power gained up to a sum total equal to the value of the twelve pounds per square inch made available by the

SECTIONAL VIEW OF THE WORTHINGTON INDEPENDENT CONDENSER.

vacuum. The independent condenser is also used in connection with fire-pumps, mine-pumps, and water-works pumping-engines, as well as with vacuum pans and other evaporating apparatus. They are made by Henry R. Worthington of this city.

THE DEVELOPMENT OF THE POTTERY INDUSTRY OF THE UNITED STATES.

MR. WILLIAM C. DAY, in the recent issue of the "Report on the Mineral Resources of the United States," traces the history of the pottery industry, which has of late become of considerable importance.

The first pottery established in the United States was in New York City, in its earliest days, when under Dutch rule. It was situated near the North River, above the present Chambers Street, the locality being at that time well out of town, in the country. More than a century ago, perhaps, a small pottery was established in Trenton, N.J., by some Frenchmen. Here porcelain, similar to what is now known as French china, was made, and it is said that the goods were very creditable. This establishment existed for some years, but it attained no great importance. At Philadelphia there was a similar pottery venture, also making porcelain or china wares, which are well spoken of for quality. This enterprise was sustained for a number of years, but failed to reach a permanent existence.

There were other attempts to establish potteries in various parts of the country from time to time, and the only one which seems to have given the greatest concern to English manufacturers was one established in South Carolina. This was contemporary with the great Josiah Wedgwood, who has been called the father of the pottery industry in Great Britain, from the fact that he made great improvements in the quality of earthenware, which gave a very great impetus to the business in England. This South Carolina pottery proved quite alarming to Wedgwood, as he feared that it might become a dangerous competitor in supplying the earthenware markets of the colonies: he therefore petitioned Parliament that the manufacture of such goods be prohibited. He seemed to think, that, with the excellent materials found in South Carolina for making earthenware, the industry would become a successful one. His fears, however, proved groundless, as the unequal struggle was of short duration.

One or two pottery enterprises, inaugurated within the past forty years, making special articles of white crockery-ware rather than a general assortment, maintained their existence only, and cannot be termed successful.

The term "pottery industry," as understood at the present time, does not include the many little potteries scattered all over the United States, making stone-ware jugs, pie-plates, drain tile, yellow crockery, etc., and which employ from six to twenty men each. These little establishments made the cheapest and commonest class of pottery products, with which foreign competition was powerless. Owing to the very low-priced class of such wares, the expenses of their importation bore so large a proportion to their cost at the foreign potteries, that competition was out of the question. In fact, in many cases the crates in which the goods were packed, and the inland transportation charges, equalled the original cost of the goods themselves. The pottery industry, as now spoken of, had therefore practically no existence in the United States in 1861, the several hundreds of so-called potteries in this country which statistics show then existed being all of the class above referred to. The Morrill Tariff Bill, and the increase of duty from 24 to 35 per cent, and the subsequent increase to 40 per cent, did not act as inducements towards the establishment of any new enterprise. In 1863 the rapidly increasing premium on gold offered the necessary inducement, and several pottery enterprises were inaugurated. These manufactured at first the commonest class of crockery-ware for domestic uses; but as experience gave confidence, and the wares gradually found favor, better grades were made, until the standard of the china-ware used by the millions of American citizens, and manufactured in this country, is recognized as equal to that made anywhere. It is true that there are several potteries in the United States who make more or less of very fine art pieces, which are forcing recognition on account of their superior excellence; but the stability of the pottery industry rests upon the fact that it supplies the wants of the people for fine and common crockery for domestic uses, of which we in this country manufacture about 60 per cent. The American potter does not claim to be the peer of his foreign competitor in art productions, but he does claim to equal any foreign manufacturer in the class of china which he produces for the American people. To-day the English potter is copying American shapes, designs, and styles of decorations. How different is this state of affairs from that which existed a few years ago, when the American potter depended upon foreign ideas for his shapes and designs! With the development of the manufacturing process, talent for designing shapes and patterns or styles of decoration has likewise progressed, until we have made our own American shapes and designs, which foreigners have been compelled to copy and adopt in order to find a market for their wares in the United States.

This country still takes about 40 per cent of the total crockery-ware exported by England. This is about the proportion that has been maintained for many years, thus showing that the American potter has increased his output in keeping with the increased consumption of the country.

In regard to the present prices of pottery, it may be said that the consumer can now obtain for two dollars and a half what in 1861 would have cost four dollars.

The pottery industry gives directly employment to about ten thousand people, to whom wages amounting annually to four million dollars are paid; this amount being nearly 50 per cent of the total value of the output of the potteries. In addition to these, there are many thousand more employed in the preparation of the materials for the potter's use, such as mining the clays, quartz, and felspar, and grinding and washing the materials. To these people nearly as much more in wages is paid; in fact, a careful estimate shows that 90 per cent of the cost of manufacturing pottery is paid for labor in one form or another.

The decorating branch of this industry is one of its most interesting features, and one in which great advances have been made in late years. It gives employment of a light, interesting, and elevating character to many young people, both male and female. The growth of this branch has been wonderful, and has made the demand for beautiful decoration, both simple and elaborate, very general, and far more wide-spread throughout the country than ever before. Formerly beautiful decoration was to be found only in costly French and English wares, and the consumption was consequently limited to the wealthiest classes: now beautiful decorated wares are found in almost any household, where they have been obtained at prices which would have been considered impossible a few years ago, and which have reduced very greatly the cost for French and English decorated products, and to a very great extent have enabled American decorated ware to supersede the foreign.

HEALTH MATTERS.

YELLOW-FEVER. — Dr. George M. Sternberg, U.S.A., has been relieved from duty at Baltimore, and is, by direction of the President, in pursuance of the authority contained in the provisions of the Act of Congress approved March 3, 1887, "making appropriations for sundry civil expenses of the government," etc., relating to the methods of preventing the spread of epidemic diseases, to proceed to the Island of Cuba for the purpose named in the letter of the President addressed to the secretary of war, April 17, 1888, and upon completion of this duty to return to his proper station and submit his report to the President. Dr. Sternberg is at the present time at the Hoagland Laboratory, Brooklyn, of which he is general director, engaged in making his preparations for his proposed trip to Cuba to pursue his investigation in yellow-fever. He expects to leave for Havana during the latter part of March.

LEGAL REGULATION OF MEDICAL PRACTICE. — The laws of West Virginia require that every physician in that State must have a certificate from the State Board of Health to entitle him to prac-